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CONTENTS.

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THE PROCEEDINGS OF THE AMERICAN SOCIETY OF ZOOLOGISTS.

THE fourth annual meeting of the Central Branch of the American Society of Zoologists and the second triennial meeting of the entire society was held in the museum lecture room at Ann Arbor, on December 27, 28 and 29, 1905. There were elected to membership in the Central Branch, Professor Burt G. Wilder, Professor W. J. Baumgartner and Professor S. J. Hunter; in the Eastern Branch Dr. N. M. Stevens, Professor Francis B. Sumner, Professor Charles G. Rogers, George Thomas Hargitt, Professor Edwin Linton, Dr. H. H. Newman, Dr. Emily R. Gregory and Dr. William E. Kellicott.

Officers of the Central Branch were elected as follows:

President—C. C. Nutting.
Vice-president—Geo. Lefevre.
Secretary-Treasurer—T. G. Lee.
Member of Executive Committee—J. G. Needham.

In the absence of any of the officers of the Eastern Branch they were reelected for another year.

The following papers were read:

The Living Egg of Anodonta as an Object for the Study of Maturation and Fertilization: CHARLES ZELENY, University of Indiana.

The living eggs of Anodonta may be of considerable value to inland laboratories where the lack of suitable material has been very striking as compared with the richness at the seashore. Contrary to the condition in *Unio*, the living eggs of *A. grandis*

and *A. edentula,* because of their transparency, are very suitable objects for the study of maturation, fertilization and early cleavage. The maturation divisions can be followed with ease and even the chromosomes can be made out as highly refractive bodies in the equator of the spindle. A study of the approach of the male and female pronuclei confirmed the observations of Lillie on sections of the *Unio* egg regarding the disappearance and reappearance of the central sphere. The central sphere at the side of the male pronucleus disappears as the two pronuclei approach each other and for a considerable period there is no sign of a central sphere in the egg. Then a central sphere forms in connection with each pronucleus and astral radiations appear around it. The two central spheres thus produced serve as the centers of the first cleavage spindle.

On the Interpretation of the Maturation Chromosomes of the Orthoptera: C. E. McClung, University of Kansas.

A very general interest centers about the interpretation of the chromosomes of the grasshoppers since every possible derivation of the tetrads has been described as showing itself in their spermatocytes. Thus Wilcox detects a double cross division, de Sinéty a double longitudinal one, while I and my students are convinced that in most of the tetrads there are present for the first spermatocytes a plane of longitudinal cleavage and for the second a cross division. Montgomery, from a brief study of one species, argues for a cross division in the first spermatocytes and a longitudinal in the second. From the fact that all these interpretations have been based upon practically the same material, it is important to determine which is the correct one, for it will materially strengthen the assumption that this is the type that is generally prevalent. I have recently gone over a large number of species of Acrididæ and am convinced that my early conception of the tetrad as a rod split lengthwise and again at right angles to this, with the mantle fibers attached at the level of the cross split, is the correct one. These two planes of division have been found in the very early prophases and traced through the two spermatocyte divisions. The ring figures present indisputable evidence that the first cleavage of the rod is along the length of the chromatin thread. These facts are demonstrated by a large series of photomicrographs.

The Chromosome Complexes of Hesperotettix speciosus and H. viridis: C. E. McClung, University of Kansas.

As I reported at the preceding meeting of the society, the genus *Hesperotettix* has a peculiar grouping of the chromosomes that characterize the Acrididæ. This manifests itself particularly in the multiple chromosome which is constituted of one of the large tetrads and the accessory chromosome. The two species of the genus show differences in size and shape that are striking and unmistakable, but which are not easy to describe. A full series of illustrations will be presented in a subsequent paper. Accompanying the chromosomic differentiation there is also one of the spindle of the first spermatocyte. This in *H. speciosus* is long and full while in *H. viridis* it is short and weak. In another species, *H. pratensis,* that is just being taken up for study, the same elements are characteristically different from the other two species, but have the generic features equally well marked.

Further Observations on Artificial Parthenogenesis: George Lefevre, University of Missouri.

In a former communication[1] some pre-

[1] Science, N. S., Vol. XXI., No. 532, p. 379, March 10, 1905.

liminary results were reported from a study of artificial parthenogenesis in the echiuroid *Thalassema mellita* Conn. At that time it was stated that unfertilized eggs of this worm may be induced to develop into actively swimming trochophores by immersion for a few minutes in dilute solutions of acids, both inorganic and organic.

Continued and more detailed examination of the material has yielded many additional facts of interest.

The parthenogenetic development in many cases involves a perfectly normal maturation, a more or less regular cleavage, and the usual processes of differentiation leading up to the formation of the normal larva.

The unfertilized egg of *Thalassema* when left in sea-water exhibits no developmental changes, and the germinal vesicle remains intact until the egg dies. After a short exposure to the acid-solutions, however, the egg rounds out upon a return to pure sea-water, and throws off a typical fertilization-membrane. As a rule, both polar bodies are extruded, and sections show that in these eggs the maturation-mitoses occur in a normal manner. After maturation, the egg-centrosome and aster disappear; the pronucleus forms from the reduced number of chromosomes and moves to the center of the egg; the two cleavage-asters with their centers appear *de novo* and simultaneously at opposite poles of the egg-nucleus; the first cleavage-figure is then formed, and division of the egg into two equal blastomeres takes place normally.

In many cases, subsequent cleavages occur in a normal manner, as far as they can be followed, although the rhythm of division is more or less disturbed; in such cleavages, cytoplasmic division regularly accompanies division of the nucleus, and the mitotic phenomena involved are in all respects normal in appearance. The reduced number of chromosomes (12), however, persists, and has been repeatedly counted even in late blastula- and gastrula-stages.

Gastrulation consists of the insinking of an entoblastic plate of cells which multiply by division and give rise to the enteron; the latter becomes secondarily divided into stomach and intestine; the œsophagus is formed after gastrulation by an ectodermal invagination which is subsequently placed in communication with the stomach. These processes of differentiation, together with the formation of the prototrochal band and apical flagella, are in all essential respects identical with the corresponding normal events.

In addition to the cases mentioned in which the normal differentiations are closely paralleled, many abnormal processes have also been observed. In some experiments only one polar body was extruded, and in others neither was formed; upon sectioning such eggs, it was found that either one or both maturation-mitoses take place well below the surface and without accompanying cytoplasmic division. Certain interesting phenomena are associated with these unusual processes, to which only a reference can be made in this place.

The formation of large monasters was not infrequently observed, the rays appearing and disappearing rhythmically and the chromosomes dividing repeatedly without cleavage of the cytoplasm.

Nuclear division occurring in the absence of cytoplasmic division often results in a multiplication of chromosomes, which may then be gathered into a single giant nucleus or grouped on a single giant spindle.

An endless variety of abnormal cleavages, similar to those described by others, have been observed; such cleavages frequently lead to the formation of ciliated structures, which, however, depart more or

less widely from normal embryos and larvæ.

Differentiation of the egg does not occur in the absence of cleavage, and all ciliated bodies observed, whether normal or abnormal, possess a cellular structure.

The Keimbahn of Chrysemys: Bennett M. Allen.

Morphology of Cœloplana: J. F. Abbott, Washington University.

Ample material was rediscovered in Japan. Careful histological study shows that contrary to frequently expressed opinion *Cœloplana* has practically no planarian affinities and can not be considered a primitive form, but rather a highly specialized ctenophore. The adoption of littoral habits has produced great divergence from the typical organization of ctenophores. On the other hand, there are many points of structure characteristic of pelagic Ctenophora that are retained in *Cœloplana* as vestigial structures, apparently useless to a crawling animal, but indicating a pelagic origin. Among the points worked out in *Cœloplana* new to ctenophore morphology are the development of respiratory dorsal tentacles, the normal sloughing off of digestive epithelium from the gastric canals and a method of origin of the adhesive cells of the tentacles at variance with the descriptions of other investigators.

The Origin of the Proglottids in the Cestode Crossobothrium laciniatum: W. C. Curtis, University of Missouri.

The method accepted as the universal one by which the proglottids of a cestode originate, does not obtain in the species *C. laciniatum*. This cestode, instead of forming its proglottids by the appearance of each new one between the scolex and the most anterior proglottid of the chain, shows the proglottids originating in the following manner: there appear at the posterior end of the young worm segments which we will term the 'posterior proglottids.' These extend over about the posterior fourth of the body and arise from behind forward after the manner described for other cestodes. When about fifty such 'posterior proglottids' have appeared, others, which we will term the 'anterior proglottids,' begin to develop in the region just behind the scolex. These 'anterior proglottids' appear *in the reverse direction so that the oldest is the one next to the scolex.* From this time on the worm is, therefore, segmenting from both ends toward a point somewhat anterior to the middle of its length.

The anterior end produces upwards of fifty, the posterior upwards of two hundred, proglottids before the two meet and all sign of the transition from one region to the other disappears.

After reaching such an 'adult' condition, no more proglottids are formed until the ones already in existence have been greatly reduced in numbers by the liberation of motile proglottids from the posterior end. When this reduction has progressed so far that the reproductive organs are beginning to appear well into the region occupied by proglottids which had an anterior origin, the part of the worm between the scolex and the most anterior proglottid elongates into a neck which eventually segments into posterior and then into anterior proglottids as did the young worm.

The bearing of these facts upon current explanations of the nature of the cestode body will be discussed in a forthcoming paper.

Some Observations on Gastropod Nerve Cells: W. M. Smallwood and C. G. Rogers, Syracuse University.

This report includes studies on the opisthobranchs, nudibranchs and especially the pulmonates, *Planorbis* and *Limax*. Many cytological observations have already been

made on the finer structure of invertebrate nerve cells, but no one has combined to any extent physiological experiments on the same animal. So many terms have already been proposed for the structures described by other writers that no attempt is made to homologize these several terms.

In the cytoplasm of *Limax* and *Haminea* there is present in the animal taken from its normal habitat a varying number of lymph spaces which exhibit neither a constant shape nor a constant position. In some instances the limiting wall of the lymph space takes a definite stain, while in others there is no indication of a structure which we might designate as a wall. These lymph spaces in *Limax* are either free from any solid staining bodies or there may be as many as a dozen different bodies in a single space. To be sure that these spaces and bodies were normal characteristics of the cytoplasm, the nerve collar was dissected from the living snail and individual nerve cells studied. The spaces can be seen in the unstained living nerve cell, but the bodies only when some neutral methylene blue is introduced under the cover glass.

The experimental evidence indicates that, contrary to the usual observations on nerve cells, the nucleus shows no evidence of shrinkage. When *Limax* is stimulated until exhausted by induction currents or a needle the bodies which are so prominent in the unfatigued animal have disappeared. In order to ascertain what became of these bodies the living nerve cell was mounted on a slide between electrodes of platinum foil and the alternating current from an induction coil was then passed between the electrodes. Within a half hour the dark bodies began to break down; within an hour or an hour and a half they had entirely disappeared. After a period of rest new bodies similar to the old ones again appear in the cytoplasm. It seems to us highly probable that these bodies are stores of energy giving stuff which may be called on in emergency to renew the protoplasm of the cell.

The bodies found in *Planorbis* seem to be entirely different from those found in *Limax*. When *Planorbis* is fed on chestnuts for a few weeks a large number of golden-yellow bodies can be seen in the unstained nerve cell accumulated chiefly around the base of the axone. These bodies do not stain with methylene blue nor disappear when subjected to an electrical stimulus.

Experiments and analyses are under way to determine the nature of these bodies.

The Nematocysts of Eolis: O. C. GLASER, University of Michigan.

The evidence of Wright ('58), Grosamor ('04[2]) and myself ('04[1] and later) that the nematocysts in the cerata of *Eolis* are derived from cœlenterates was reviewed and found valid. The adaptiveness of these transferred nettling organs, however, is not as easily determined as their origin. Since they discharge and inflict pain, they are as efficient in these respects as before ingestion. My observations show, however, that despite their great concentration in *Eolis*, they are not as generally effective as has been supposed. In combats with its own kind, the cerata are attacked directly and eaten voraciously.

When irritated, *Eolis* curls up; the cerata project like quills from a porcupine, or are cast off by autotomy. An attacking fish is certain to fill its mouth with nematocysts, both because the appendages containing them are numerous and because they are most conspicuously colored.

Various fishes behave differently in the presence of *Eolis*. The blennie, which lives in great numbers on the same hydrids with *Eolis*, ordinarily is indifferent to the presence of the latter, but when aroused by

hunger, or another cause, crops the cerata until none remain.

Fundulus at first is excited in the presence of *Eolis,* but on longer acquaintance will take detached appendages if offered. I have never seen a *Fundulus* repeat this act, though it will devour, even after having taken detached cerata, an *Eolis* devoid of them. This seems to indicate that the colors of the appendages are warning colors.

The elaborate preparations made by the cnidophore sacs for receiving and storing the nematocysts indicate the advantage to *Eolis* of ridding itself of these structures. Probably their use as weapons, in cases in which they so serve, is secondary and accidental, the real and original function of the cnidophore sacs being the elimination of the nematocysts.

The Sense Organ of the Bill and Lateral Line of Polyodon Spathula: Henry F. Nachtrieb, University of Minnesota.

Correlated Abnormalities in the Scutes and Bony Plates of Chelonia: H. H. Newman, University of Michigan.

An examination of the carapaces of large numbers of *Graptemys geographica* and *Chrysemys marginata* show that there is always a precise correlation of supernumerary or deficient scutes and plates of the marginal series. In the neural series correlation is frequent between extra procaudal plates and the supernumerary scutes of that region.

No correlated abnormalities were found in connection with the true neural or costal plates which are produced by periosteal expansions of the ribs and neural spines of the vertebræ.

Correlations occur only in regions where plates of dermal origin exist—in the marginal and procaudal regions. This may be used as evidence in support of the theory that there existed at one time a dermal carapace composed of tubercular or flattened chitinous elements (scutes) with cores or supports of dermal bone. The rapid secondary expansion of ribs and neural spines rendered these dermal bony supports superfluous in the large central portion of the carapace, but in other regions they persisted as the marginal, nuchal, procaudal and pygal plates.

In these regions, then, we should not be surprised to find correlated recurrences of lost scutes and plates, since a genetic connection exists. The procaudal and pygal plates are distinctly in serial homology with the dorsal processes of the tail of *Chelydra,* leading to the belief that such processes at one time extended much further forward.

Vestiges of dermal bones in the mid-neural region of the carapace were found in *Graptemys* in just the places where they would be expected—beneath the keels of the second, third and fourth neural scutes. A considerable amount of additional evidence in support of this view will appear in a paper now in press.

The Production and Control of Infertility by Inbreeding: W. J. Moenkhaus, University of Indiana.

The Direction of Differentiation in a Regenerating Appendage: Charles Zeleny, University of Indiana.

The problem of the direction of differentiation in a regenerating appendage was studied in the antennule of the common brook sow-bug, *Asellus,* which is exceptionally favorable because of striking and constant differences in the segments. It was found that the visible differentiation starts at the basal and terminal ends and proceeds toward the middle of the regenerating tissue. The basal differentiation, however, appears slightly in advance of the terminal one.

The Regeneration of an Antenna-like Organ in place of the Vestigial Eye of the Blind Crayfish: CHARLES ZELENY, University of Indiana.

In the blind crayfish (*Cambarus pellucidus testii*) the eyes have become degenerated to such an extent as to be perfectly functionless. The retinal structures if present at all are represented merely by a few small groups of granular cells. The right eye-stalk was removed in nine specimens of this crayfish. Three lived for a year after the operation. One of these regenerated an antenna-like organ in place of the removed eye-stalk. The new organ is segmented and the terminal half is covered with tactile hairs. All appearances point toward the supposition that the organ is a functional one and its function is probably tactile in character. The instance, therefore, represents a case of the regeneration of a functional organ to replace a removed non-functional one.

The Young of Scutigerella immaculata: S. R. WILLIAMS, Miami University.

A *Scutigerella,* which had remained quiescent for ten days beneath a glass slide (in a bubble of air) in a stender dish, laid eight eggs on May 25, 1904.

She remained with the eggs continuously until they hatched on June 6. June 7 one was removed. It proved to have six pairs of legs, as was previously stated to be the probability at the St. Louis meeting of the Association for the Advancement of Science.

The disturbance of the nest caused the mother to desert the remaining young and by the morning of the following day these had all disappeared. It is practically certain that they were eaten by the other *Scutigerellas* in the stender dish.

The San Diego Marine Biological Association and its Work: C. C. NUTTING, University of Iowa.

Some Points on the Habits and Anatomy of Placobdella Pediculata, N. Sp.: HENRY F. NACHTRIEB, University of Minnesota.

An Ecological Survey of Isle Royal, Lake Superior: CHAS. G. ADAMS, University of Michigan.

The Pearl Organs and Spawning Behavior of American Suckers and Minnows and their Bearing upon Current Theories of the Origin of Secondary Sexual Characters: J. REIGHARD, University of Michigan.

Some Relations of Protozoa to Certain Ions in their Medium: A. W. PETERS and M. H. REES, University of Illinois.

In one series of experiments the resistance of *Paramœcia* to low concentrations of H and OH ions was tested by keeping the animals in media consisting of pure salt solutions made to contain a serial range of known concentrations of H and OH ions. Tests were also made with distilled water. No food or other organic matter was present in any of these media. The numerical results showed a greater resistance in the OH than in the H media. In another series of experiments further tests upon the resistance of *Paramœcium* and *Colpidium* to H and OH ions were made under conditions as nearly natural as possible. The original nutritive media were subjected to quantitative chemical and physical examination and in different portions of these media a serial range of concentrations in H and OH was produced and also quantitatively estimated. The animals having lived for twenty-four hours or longer in media so prepared, were subjected in the same media to instantaneous killing tests, one of which consisted of pure HCl, the other of HCl + NaCl. The least gram ionic concentration of H which killed instantly was accurately determined and was taken as the measure of resistance. Curves representing all the results show

that the animals that have lived in media containing OH ions have a lower resistance to HCl than the animals that have lived in media containing H ions. *Colpidia* have a higher resistance than *Paramœcia,* for both H and OH media. The HCl + NaCl solution has a greater effect on both *Paramœcium* and *Colpidium* than the same concentration of HCl used alone would have. Experiments here made show that the NaCl used alone is physiologically favorable. The increased effect when both are used is due to greater gram ionic concentration of H which would be expected in the mixed solutions in accordance with conductivity measurements of Lincoln and of Jones and Knight.

Phagocytosis in a Mammalian Embryo: M. M. Metcalf, Oberlin College.

On the Rôle of the Substantia reticularis in the Evolution of the Vertebrate Brain: J. B. Johnston, University of West Virginia.

The vertebrate nervous system consists of somatic sensory, visceral sensory, somatic motor and visceral motor divisions. Each of these divisions is represented by central and peripheral structures in each segment of the head and trunk, except where the organs to be innervated are wanting. The central portion of each division constitutes a continuous zone or column in the spinal cord and brain. These longitudinal columns are the fundamental divisions of the central nervous system. In addition to these there are in the central system numerous cells which are left over after the four main columns are differentiated. These cells serve functions of connection and correlation between the four columns and between distant segments of the central system, and constitute the substantia reticularis grisea. The cells of the substantia reticularis are indifferently scattered throughout the four divisions, and when one or other division is absent they form the whole gray matter in its place.

The very important rôle which this substance plays in the formation of higher brain centers is illustrated by the gustatory and olfactory centers and by the evolution of the cerebral hemispheres. The gustatory central apparatus in fishes includes a secondary nucleus in the cerebellar segment and a tertiary nucleus in the inferior lobes of the diencephalon. Both of these are probably differentiated from the substantia reticularis occupying the primitive visceral sensory zone. The relations of these structures in fishes should serve as a guide in discovering the gustatory centers in man. The olfactory apparatus has secondary nuclei in the forebrain and tertiary nuclei in the inferior lobes and in the nuclei habenulæ of the diencephalon. These tertiary centers belong to successive neuromeres of the primitive brain and to the same chief zone. The cerebral cortex comes from two sources. The one is the visceral substantia reticularis called epistriatum in lower fishes, which forms the hippocampus. The other is an unknown starting point possibly identical with the center of the *N. terminalis* in fishes, which forms the general pallium whose functions are primarily the direction of actions with reference to the outside world.

A New Form of Cutter for Wax Plates: E. L. Mark, Harvard University.

An Oil-Immersion Paraffine Bath: George Lefevre, University of Missouri.

A paraffine-bath was described which has been designed upon a new principle. Each cup or vessel used for holding paraffine is suspended in a well containing oil, which is, therefore, in contact with the sides and bottom of the vessel. By the application of heat through the mantle of oil, a uniform temperature throughout the paraffine is obtained, and, owing to the low con-

ductivity of the oil, the surface of the paraffine may be exposed to the air indefinitely without congealing; and, furthermore, since a film of warm oil adheres to the outside of the vessel when the latter is taken from the well, the paraffine remains melted off the bath for a considerably longer time than it does without this protection, thus making possible a much more leisurely process of embedding.

The advantage of immersing the vessel in oil is especially conspicuous in embedding free, minute objects, like small eggs, which have been saturated with paraffine while contained in glass vials and which must be handled by means of a pipette.

The oil which has been usually employed in the bath has been olive oil.

A Case of Dibothrocephalus latus Infection Acquired in America (Minnesota): W. S. NICKERSON, University of Minnesota.

The author reports the first known instance of locally acquired infection by the broad human tapeworm. A Finnish child, born in Minnesota, which had never fed upon imported fish of any kind, passed a specimen of *Dibothrocephalus latus* seven feet in length. Since infection from this worm can take place, so far as known, only from eating fresh-water fish that are infested with the larval form (plerocercoid), it is practically certain that American fishes have become the hosts of this parasite. In endeavoring to account for this condition the author suggests that the sewage from cities with a large foreign population may be sufficient to furnish the required infection of the intermediate host. Since at least ten European species of fish serve in this capacity, it is not unreasonable to conclude that there would be found in this country some forms in which the larvæ of the worm would thrive.

C. E. MCCLUNG,
Secretary.

TOWN AND GOWN.[1]

ON an old French sun-dial is a motto to this effect: All passes in time and time itself; but eternity does not, nor love. This last is the permanent thing, in which the universe and human society are founded. So these hundred and fifty years of our university, just past, being as they were but a moment in the morning of its life, compel us to look not backward, but at the present and the future. The Greek fool who ran so far to get a start that he could not jump when he reached the mark is perhaps a symbol of some university men who spend their lives in preparing to live; but not of the university itself, which renews its strength in action and endures forever, if true to itself. Founded in faith and devoted to liberal learning, Columbia has successively welcomed faculties of the learned professions and faculties of natural and applied science, fearless, persistent, aggressive. The boughs rival the trunk; action and reaction develop a wholesome struggle; the air hereabouts is keen and sometimes both tense and tumultuous. We have not merely renewed our youth, we have transformed ourselves and start afresh.

Among the questions of our new morning is this: Have we a new conscience and what about the moral sense of our community? For example, certain trademarks have a high commercial value. Such an one is the bachelor of arts. Its chief renown, however, is intellectual and social. The reason is that for ages it connoted a certain training. Those who held it have been the heirs of human experience; they have understood the continuity of thought, the organic nature of society and its institutions, the value of order and proportion, the charms of fancy and imagination, the interpretation of the past for use in the present and future. From them comes the birthright because among them were

[1] Address at the opening exercises of Columbia University, 1905.